**South Dakota Agricultural Education (AFNR)**

**Academic Integration Activities**

**ACTIVITY #7**

*Ag Power Technology students will add, subtract, multiply and divide real numbers including integral exponents when figuring Ohm’s law.*

**1. Ag Standard**

Ag Power Technology, 3.9: Illustrate various electric motor types, operation and maintenance.

* Calculate problems using Ohm’s law.

**2. Academic Standard**

9-12.N.2.1: Students are able to add, subtract, multiply, and divide real numbers including integral exponents.

**3. Background Information**

**Ohm’s Law** is the foundation of understanding electronics and electricity. The diagram below shows all of the equations and relationships between power (represented by a P, measured in watts), voltage (represented by an E, measured in volts), current (represented by an I, measured in amps), and resistance (represented with an R, measured in ohms).

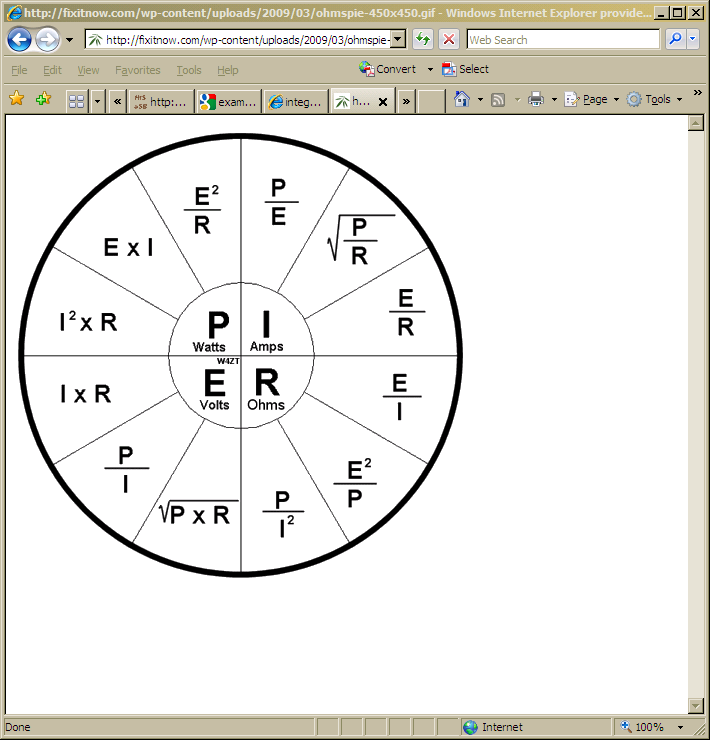


Image retrieved from: <http://fixitnow.com/wp-content/uploads/2009/03/ohmspie-450x450.gif> on July 27, 2011.

Some of the equations used in Ohm’s Law include **Integral Exponents.** Integral exponents are written with a base number and an exponent. For example in 42, 4 is the base and 2 is the exponent. What 42 actually represent is 4 \* 4, which equals 16.

**4. Example In Context**

The radio in a tractor with a resistance of 30 ohms has a current of 0.1 amps flowing through it. Calculate how much power must be supplied to make it work.

Identify what we know. I = 0.1 amps, R = 30 ohms, we want to find P.

Identify the equation to use. P = I2 \* R

Plug I and R into the equation to solve for P.

P = 0.12 amps \* 30 ohms

Following algebraic order of operation (Parenthesis – Exponents – Multiply – Divide – Add – Subtract) continue the calculation.

P = 0.01 \* 30

P = 0.3 watts

**5. Guided Practice Exercises**

Assume a student needs to replace a headlight on a Farmall Super M. When she went to the tractor supply dealership, she was given a 35 watt bulb. She knows the battery in the tractor is 12 volts. What does the resistance of the bulb need to be for it to work properly?

First, identify what we know. P = 35 watts, E = 12 volts, we want to find R (ohms)

Identify the equation that will work for the information we are given. R = E2/P

Plug in the information. R = 122/35

Following algebraic order of operation (Parenthesis – Exponents – Multiply – Divide – Add – Subtract) continue the calculation. R = 144/35

R = 4.1 Ohms. The bulb must have a resistance of 4.1 ohms to work properly.

**6. Independent Practice Exercises**

Assume a student is installing a corn planter monitor on a tractor. The tractor has 2 - 6 volt batteries and the monitor has a resistance of 50 ohms. How much power will the monitor need to run properly?

*Answer: 2.88 watts(P = E2/R, E = 12 volts (the 2 – 6 volt batteries add together for a total of 12 volts, R = 50 ohms, P = 122/50, P = 144/50, P = 2.88)*

Assume a student is replacing one of the monitors on a tractor console. What is the resistance needed in this circuit if it is a 15 watt, 2 amp monitor?

*Answer: 3.75 ohms (R = P/I2, R = 15/22, R = 15/4, R = 3.75 ohms)*

**7. Notes**

None